Milk Quality and Mastitis
Basic Principles

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Cows Get Mastitis Four Ways

Nelson Philpot, 1962
Three Ways Cows Get Mastitis

- Contagious organisms spreading through the herd.
- Environmental organisms infecting milking cows.
- Cows becoming infected during the dry period.
The labile nature of udder infection

Dodd et al.
Organisms Commonly Associated With Mastitis

- Strep. agalactiae
- Staph. aureus (coagulase positive)
- Mycoplasma
- Strep. species (non ag.)
- Staph. species
- E. Coli
- Klebsiella
- Arcanobacterium pyogenes
- Corynebacterium bovis
- Bacillus
Other Organisms Associated With Mastitis

- Pseudomonas
- Yeast
- Pasteurella
- Prototheca
- Proteus
- Other bacteria
Groups of Bacteria

Contagious (*source of bacteria is an infected cow*)
- Strep. ag
- Staph. aureus
- Mycoplasma

Tend to
- Spread from cow to cow
- Cause long term infections
- Cause significant economic loss
Groups of Bacteria

Environmental *(source of bacteria - cow environment)*

- Strep species (non ag.)
- Coliforms (E. Coli - Klebsiella)
- Staph species (coagulase neg.)
- And many more

Tend to

- Originate from environment
- Be shorter term infections
- Self cure is associated with degree of exposure and virulence of bacteria
Iceberg Principle

Economic Impact of Clinical vs. Sub-clinical Mastitis

The economic effect of sub-clinical mastitis is significantly greater than that of clinical mastitis.
Many factors may be related to mastitis

Weather
Facilities – Wet and dirty bedding – Manure
Milking machines
Sanitation – Improper udder preparation
Transfer from other infected cows
And others …
However, it is mainly because of their effect on bacteria

Changes in numbers
Changes in types
Facilitate entry into the udder
When you know the organisms are present in a dairy operation, identify a specific approach.

- Use diagnostic tools to determine the area of greatest opportunity
- Concentrate efforts in area(s) where the producer will have the greatest return – prioritize recommendations

It is very important to know what mastitis pathogens are present in a dairy herd so that specific mastitis control/eradication procedure can be implemented.

Concentrate on those mastitis control procedures that will bring the greatest return and/or have the greatest chance of being successfully implemented.
If we can determine the source of most infections, we can more effectively and economically target control measures.
Contagious organisms are carried from cow to cow

- Proper procedures during milking
- Follow recommended guidelines for milking procedures
- Use gloves
- Do not use common towel or bucket for washing teats
- Use individual towels for each cow for drying
- Replace teat dips and sanitizers with new fresh products and from closed containers
- **Make sure each cow is clean and properly stimulated when milking machine is attached**
Is good cleaning enough?

The dirtier the cows, the more difficult to get clean.

It is important to keep bedding material as clean as possible but nothing will replace good procedure during pre-milking hygiene.

Infection occurs primarily during milking but will also occur between milkings.
Role of the Milking Machine

To provide effective milking of lactating animals with minimum stress and machine-on-time.
The only time during milking that organism transfer thru the streak canal can occur is when there is no milk flow. To avoid a time with no milk flow during milking, the milking machine needs to be attached after the cow has achieved complete milk let down and removed before complete stoppage of milk flow. This can be consistently achieved when adequate teat stimulation (cleaning and fore-stripping) is followed by a 60-120 second prep-lag-time and when the milk flow sensor is set (if ATO is used) to remove the milking machine prior to complete stoppage of milk flow.
Take Home Message

- Make sure cows are properly stimulated before milking unit is attached.

- Follow recommended pre-milking procedures and prep-lag-time before milking unit is attached.

- Milk should be flowing when unit is attached.

- Milking unit should be removed without over-milking.

- Detachers should be set to remove the milking with low “Milk Flow” and short “Delay Time”.
Healthy teat canal is major barrier to bacteria
The greater the number of bacteria at the bottom of the teat at the time of milking unit attachment, the greater the risk of new mastitis infections.
If the teat end and teat canal is structurally in good condition, the sphincter muscle should maintain tight closure and the keratin should serve as a physical barrier.
The infusion nipples currently used have a step-out to prevent the tip from entering into the teat cistern. It will not penetrate more than a short portion into the streak canal.

To help prevent bacterial transfer thru the teat canal while infusing antibiotics and other compounds, (A) partial insertion is strongly suggested.

If the insertion extends into the teat cistern (B), bacteria can be transferred in the same process.
When bacteria enter the mammary gland, they are recognized by the leukocytes. Antibodies perform that function to allow the leukocytes to kill the invasive bacteria.
(A) The bacteria may adhere to the internal tissues and that may prevent them from being flushed out during milking.

(B) Eventually they may enter the alveoli where they multiply.

(C) Toxins produced by the bacteria cause damage to the milk producing cells which release substances to the blood stream to increase blood vessel permeability.

(D) This allows serum and leukocytes to move from the blood stream onto the alveoli. Leukocytes kill bacteria and the serum dilutes the toxins.
Endotoxin released upon death of these bacteria results in a rapid increase in the somatic cell count.
Antibodies tag bacteria for leukocytes so they can be more easily recognized and destroyed.

Neutrophils engulf bacteria (1) and store them in digestive sacs (2) in which bacteria are destroyed by enzymes (3), which migrate to the digestive sac.
Electron Microscopy Photography of Somatic Cells

The concentration of somatic cells depends on the severity of the infection (A). The somatic cell (B) is engulfing the bacteria and destroying it.
(A) Staph. aureus (black dots) may form deep seated pockets of infections in glandular tissue.

(B) The cow's immune system attempts to keep the bacteria in one place by walling off these areas with leukocytes and scar tissue.

(C) Periodically bacteria is released. If these milk ducts are not blocked more than 3 or 4 days production should return.

If these ducts are blocked longer, "dry off" may occur in the area behind the block. However, if these areas are not damaged, they may return to function normally in the next lactation.
Strep. ag. infections can drastically reduce milk production.
Immune Status of The Cow

Her immune status to a great deal governs her ability to fight off invasive bacteria and prevent mastitis infections. Good nutrition, clean environment and proper management is vital for her well being.
Hoof health has become the greatest economic factor for the dairy industry. Poor hoof health manifests itself in system stress effecting overall animal health. An animal that has difficulty with walking will stop drinking and eating. The discomfort can also affect the milking process by releasing hormones that consequently block the release of oxytocin.

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**Immune Status of the Cow**

**Stress**
- Immune suppression at calving – may also be a hormonal factor
- Over-crowding
- Ventilation
- Many others...

**Nutritional factors**
- Well balanced rations from good quality feed components
- Vitamin E and Selenium well documented
- Others...

**Presence of other disease factors**

*Example: Hoof disorders*

These factors are real and affect disease, but correcting a factor in this area alone will not likely solve a major mastitis problem.

Need to go back and look at the basics.
Factors to consider in application of some common control procedures.
Consistent milking management and procedure is very important for good milking performance results. A cow should be handled the same way each and every time when she enters the milking parlor. She should be handled gently and quietly and should be milked clean and well stimulated.
Basic Principle

If you use a teat dip disinfectant to kill bacteria on the teats, you need to make sure you get good coverage.

![Image of teats with good and poor coverage]

Good coverage

Poor coverage

Procedure for white towel test:

- Dip teats
- Use white paper towel or gauze pad
- Wrap around the teat
- Look for dry areas
Remember

Pre- and post-milking teat dipping works well for preventing new infections.

It has no effect on existing infections.

Prevention – Prevention – Prevention
Effect of Post-milking Teat Dipping on SCC

Post-milking teat dipping is primarily affective against contagious organisms.

If herd problem is primarily environmental infections and you change the post-dip but nothing happens....

you shouldn’t be surprised.
What About Pre-dipping?

Primarily effective against environmental bacteria.
Fore-Stripping Effective for:

Stimulation – Oxytocin release
Observation of good and abnormal milk
Teat Cleanliness

Teat swabs of teat ends after pre-milking hygiene procedures.
NMC Ten Point Plan for Mastitis Control

1. Establishment of goals for udder health
2. Maintenance of clean, dry and comfortable environment
3. Proper milking procedures
4. Proper maintenance and use of milking equipment
5. Good record keeping
6. Appropriate management of clinical mastitis during lactation
7. Effective dry cow management - transition cows
8. Maintenance of bio-security for contagious pathogens and marketing of chronically infected cows
9. Regular monitoring of udder health status
10. Periodic review of mastitis control program

Detailed information can be obtained from NMC website under “Resources”
Resource Information and References


NMC Website: http://www.nmconline.org/resources